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THE CHEMISTRY OF THE HIGHER FUNGI.

Chemie der höheren Pilze, eine Monographie. By Dr. Julius Zellner. Pp. vi+257. (Leipzig: W. Engelmann, 1907.) Price 9 marks.

THE detection, isolation, and characterisation of the definite compounds resulting from the vital processes of living organisms is a branch of organic chemistry which is slowly developing and of which the progress is necessarily dependent upon the development of pure chemistry. In fact, it may be said that in some respects this department of biochemistry is in advance of the pure science, because the living organism has already furnished chemists with immense numbers of compounds which are quite definite, but of which the chemical constitution is at present unknown. Indeed, it may be stated in much wider terms that there is probably no such thing as an "indefinite" chemical compound in the whole animal or vegetable world. There is no doubt that many, perhaps the majority, of the organic compounds present in animals or plants are of very high molecular weights and of great atomic complexity, and there is also no doubt that many of the products which have been isolated and studied are complex mixtures or combinations of such complexes. But to speak of such products as "indefinite" is simply tantamount to the admission that our modern methods of research are inadequate, and that our knowledge of biochemistry must develop concurrently with the development of new methods for dealing with these highly complex molecules.

The ultimate aim and object of scientific chemical work in this field is presumably to follow the development of the various compounds in the living organism—to detect the genetic relationships between the molecules for the purpose of learning how nature works in the vital laboratory. As a prelude to this knowledge it is necessary to get, in the first place, an inventory, as complete as possible, of the compounds actually known to exist in, or to be produced by, the animal or plant. With respect to plant chemistry it may be said that practically all the works dealing with this subject have hitherto been of the nature of such catalogues or inventories. Here and there, as the result of these studies, genetic relationships have been detected, but this field of research is urgently in need of systematic cultivation. As a subject it bristles with practical difficulties, and for the achievement of successful results the investigator should combine the qualifications of an expert chemist with those of the expert botanist. It is not surprising that, in the circumstances, the biostatistical aspect of plant chemistry should have progressed so much more rapidly than the biodynamical aspect.

Dr. Zellner's monograph may be regarded as another contribution to plant chemistry from the biostatistical side. It deals with a particularly interesting

group, and will be found invaluable to students and workers in this field. By the "higher fungi" the author means all those orders generally classed as fungi with the exclusion of bacteria, moulds, and yeasts. The line of demarcation, as Dr. Zellner points out, is perhaps not, strictly speaking, a scientific one, but for practical purposes it is both justifiable and convenient, as bacteriology and fermentation have been developed into large and important branches of science, and their literature is amply provided for.

In treatment the present work follows the chemical rather than the botanical classification, the chapters, of which there are twenty-two, bearing the titles of the chemical families, beginning with the mineral constituents, and passing on to the hydrocarbons, fats, lecithins, alcohols, acids, amino-acids, purine group, bases, carbohydrates, tanning and colouring matters, resins and terpenes, proteins, &c. The chapters on the ferments and toxins of fungi will be of particular interest to many readers. One chapter is devoted to the consideration of the nutritive value of fungi, which the author does not consider to be very high. In this chapter there are many valuable tables giving the quantitative results of the analysis of the proximate constituents of large numbers of species. In the case of certain chemical families of very wide occurrence, such as the carbohydrates, the author has been obliged to interpolate tables based on the botanical classification. Thus in chapter xii. there is a tabulated list of no fewer than 233 species, giving the distribution of mannitol, mycose (trehalose) and glucose, or other reducing sugar, together with the name of the observer and the year of the discovery of the carbohydrates. In giving the details of the various compounds, the author has wisely thought it unnecessary to enlarge upon the chemistry of well-known and widely distributed substances which are of general occurrence in the vegetable kingdom. On the other hand, compounds of special interest in mycological chemistry, such, for example, as muscarin, ergotin, choline, &c., which are essentially, if not exclusively, products of fungi, are dealt with exhaustively. As is so generally the case with German writers of monographs on scientific subjects, the references to authorities are fully given.

As a contribution to scientific literature there is nothing in this work calling for criticism. The author, unlike many specialists, takes a remarkably fair view of the "perspective" of his subject, and the result is a work which may be described as concisely complete. It may savour of impertinence for a "foreigner" to complain of the spelling of his own language by a German writer, but those who are in the habit of following German work in our own subjects—i.e. the working men of science of this country generally—have become accustomed to certain established modes of spelling in such scientific publications as the *Berichte* of the German Chemical and Botanical Societies, and so forth. We in this country have become "hardened" (literally) into seeing K for C (hard); we have got over the first shock of seeing such words as Glukose, Fruktose, Mykose, &c., and

we have even been obliged to admit that Muskarin is obtained from *Amanita muscaria*.¹ But now Dr. Zellner has a further shock for us, and we find such words as *Kalzium*, *Zitronensäure*, *Glyzerin*, *Azetyl*, &c., scattered throughout his pages. Thus (p. 97) Mykose forms an "*Oktoazetylverbindung*," which is no doubt chemically true, but, stated in this form, it seems to jar upon the orthographic nerve of the average English reader. All this is, of course, purely personal, perhaps old-fashioned or narrowly insular, and has nothing to do with the scientific merits of the work, which, as has already been said, are of a very high order, and every worker in the domain of plant chemistry will be grateful to the author for having produced it.

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BOTANICAL INSTRUCTION.

Plant Biology. A Text-book of Elementary Botany arranged for Modern Methods of Teaching. By Dr. F. Cavers. Pp. xvi+460. (Cambridge: University Tutorial Press, 1907.) Price 3s. 6d.

Laboratory and Field Manual of Botany. By J. Y. Bergen and B. M. Davis. Pp. viii+257. (Boston and London: Ginn and Co., n.d.) Price 4s. 6d.

Studies in Plant Life. By J. Adams. Pp. v+179. (Dublin and Belfast: Fallon and Co., Ltd., n.d.)

Elementary Botany. By M. A. Liversidge. Pp. 128. (London: Blackie and Son, Ltd., 1907.) Price 1s. 6d. net.

Introduction to Elementary Botany. By Charlotte L. Laurie. Pp. viii+84. (London: Allman and Son, Ltd., n.d.) Price 1s. net.

Our Woodlands, Heaths and Hedges. By W. S. Coleman. Pp. viii+141; with 8 plates. New edition, entirely reset. (London: George Routledge and Sons, Ltd., 1907.) Price 1s.

THE advocates of an exclusively experimental course of study in the natural sciences are confronted with the difficulty of time limitations, so that in practice it becomes necessary to strike a balance between lecture and practical work. Dr. Cavers has indicated in "*Plant Biology*" the lines of work that he has found successful with training-college students, in which the training is almost entirely derived from observation and experiment. The foundation of the course consists of experiments—of which about three hundred and fifty are outlined—in connection with the nature and function of parts of the flowering plant; so far as possible the bean plant is used as the type. Flower and soil, biology and ecology provide a subsidiary section. The course differs mainly from ordinary practice in excluding the examination of selected types from the main groups and in the general omission of flowerless plants. With regard to the composition of the subject-matter, the author deserves great commendation; the arrangement is well planned, the experiments are generally simple and practicable, and the information is contrived to make the student

think. A series of questions at the end of each chapter can be used either by the student or his instructor to gauge the progress that is being made. The appendices also contain much useful matter; hints on practical work refer to special opportunities afforded month by month; a summary of Engler's system of classification is provided, and a glossary of botanical terms.

The manual prepared by Mr. Bergen and Dr. Davis is a practical handbook primarily arranged in accordance with their text-book "*Principles of Botany*." The first part relates to the structure and physiology of seed plants. The plan adopted of outlining the instructions without detailed information that is left for the student himself to discover is good, but the authors have not been very happy in distinguishing between more and less important facts or in systematising the subject-matter. As an instance, it may be cited that the description of a typical young dicotyledonous stem is not particularly noted, while the structure of the climbing dicotyledonous stem receives undue prominence. The second part, indicating type studies of flowering and flowerless plants, is more felicitous. *Spirogyra* forms a suitable introduction for studying the cell in detail. *Pleurococcus*, *Vaucheria*, *Ulothrix*, and *Cedogonium* are chosen as the types of green algæ, while reference is also made to *Ulva*, *Cladophora*, and *Coleochaete*. *Microsphaera*, the lilac-mildew, is selected as the type of an Ascomycete, and the introduction of *Marsilia* is quite a desirable innovation. Ecology is dealt with in the third section under the headings of flower pollination, seed dissemination, types of vegetation, &c. The remainder of the book is devoted to accessory but valuable hints on reagents, methods of fixing and staining, cultures of the lower plants, and apparatus. Considered as a whole, the authors have provided a useful manual that presents a large amount of practical information in a limited amount of space.

The small book written by Mr. Adams is of an extremely superficial nature. Owing to generous spacing and a large number of illustrations, the text is less than would be expected. In the circumstances, it would have been advisable to give more space to the essentials of plant structure as exemplified in the flowering plant and to have omitted the cursory descriptions of flowerless plants and plant habitats. The author has taken pains to introduce facts of practical importance to the agriculturist, such as fertilisers, dwarf shoots, &c., but there is a lack of clearness and accuracy in some of the elementary definitions.

The limits of Miss Liversidge's book are set by the intention of covering the syllabus of work for the Oxford and Cambridge junior local examinations. It is evident that it has also been written rather with the view of giving facts for examination purposes than of training the young mind. There are four parts, assigned to external morphology, anatomy, physiology, and systematic botany. The design of the physiological part is good, but the experimental

¹ The familiar *Chemisches Central-Blatt* has now become a *Zentral-Blatt*.